Testing Packaging Integrity

At Brookfield Engineering we are frequently sent samples for testing of their rheological properties. Viscosity is, after all, our traditional role in instrumentation. In recent years Brookfield has introduced a complimentary instrument called a texture analyzer. A texture analyzer is a small compression and tension tester that is often used for food items, cosmetics and other consumer products.

When we are sent samples for texture testing it is interesting to test not only the product itself, but it's packaging as well. Puncture resistance and tensile strength are important properties, but it is much more interesting to test the closure seal. The results are often quite surprising not only to us, but to the customer as well.

In order to test the packaging seals, which are usually at both ends, cutting around its middle must open the package. This leaves the seal intact so that it can be prepared for testing. To prepare a package seal for testing the package is cut into one inch strips. These strips can then be secured between a pair of grips with the seal in the center as shown in figure 1. It is important to secure the test strip carefully so that tensile force is applied evenly to the seal as the test begins.

Figure 1: Dual Grip Assembly to imitate "tearing" or pulling motion

Such a test using a texture analyzer consists of moving the grips apart at a constant, programmed speed for a distance sufficient to completely separate the seal. During this test the texture analyzer displays the load as the seal is broken and the distance as it progresses. At the end of the test the machine shows the maximum force required at the strongest point of the closure, the distance the grips traveled at that point and the total work required to break the seal.

Differences can most easily be described by showing the load curve resulting from two tests (see figure 2). Test curves can be seen by using Texture Pro CT Software to drive the texture analyzer, but it is important to note that software is not required to obtain the necessary results.

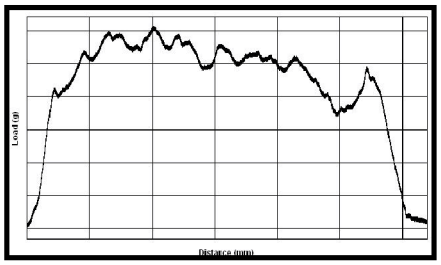

Figure 2: Test Curve on a normal package seal

The first test shows the result obtained from testing a "good" package seal. The test begins at the left side of the graph and ends at the right. The load builds quickly as tension is applied to the test sample until sufficient force is applied to peel open the seal. The wavy "mountain top" appearance of the force curve is reflective of the strength, the adhesive and the manner in which the seal was created. In this case, the seal peeled open under a relatively even application of force until it separated.

The second graph (figure 3) shows test results of another product from the same manufacturer but a different production line. This seal behaved very differently. The initial peak force caused the package to fail abruptly

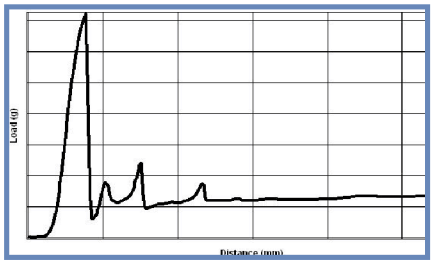

Figure 3: Testing on a weak package seal

along the edge of the closure. It did not fail completely; a small portion did peel away. This is the reason the load did not drop all the way to zero after the initial peak. The small peak near the end of the test (right side of the graph) was caused by a narrow strip of the plastic inner liner separating from the outside foil and stretching before it was released from the adhesive of the seal.

The failure of the packaging after the initial peak was caused by damage to the package from the machine making the closure. The problem was resolved by a small adjustment of the closure operation.

It is clear even by viewing the two graphs that the work of opening the two packages, which is the area under the curves, is very different between a good seal and a potentially defective one. The ratio of the peak force to the work area could give a clear distinction between a good package and a questionable one, and watching the sample under test would explain these differences. The test is fast, easy and doesn't require that the load curves be seen, so software and a computer are not necessary.

Physical testing of packaging material can assure your products will arrive in good condition to the consumer and the package can be opened with reasonable force.

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